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October 11, 2016

VIA ELECTRONIC FILING

Marlene H. Dortch
Secretary
Federal Communications Commission
445 12th Street S.W.
Washington D.C. 20554

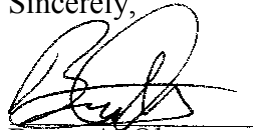
Re: Oral *Ex Parte* Notice
GN Docket No. 14-177, IB Docket Nos. 15-256 and 97-95;
RM-11664 and 11773; and WT Docket No. 10-112

Dear Ms. Dortch:

On October 6, 2016, representatives of The Boeing Company (“Boeing”) met in separate meetings with legal advisors for the FCC Chairman and Commissioners to discuss the above-referenced proceeding and the potential for spectrum sharing between the Upper Microwave Flexible Use Service (“UMFUS”) and next-generation broadband satellite communications systems in the V-band. Participating in the first meeting on behalf of the Chairman’s office was Edward “Smitty” Smith. Participating on behalf of the Commissioners’ offices in four separate meetings were Johanna Thomas, Daudeline Meme, Brendan Carr, and Erin McGrath. Participating on behalf of Boeing were Bruce Chesley, Audrey Allison, and the undersigned, along with Robert Vaughan during the meeting with Johanna Thomas. The discussion tracked closely with the attached presentation and with Boeing’s comments in response to the Commission’s Further Notice of Proposed Rulemaking.

Thank you for your attention to this matter. Please contact the undersigned if you have any questions.

Sincerely,



Bruce A. Olcott

Counsel to The Boeing Company

Attachments



Boeing Comments on Spectrum Frontiers Further Notice of Proposed Rulemaking

October 6, 2016

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Growth in Broadband Demand and Digital Divide

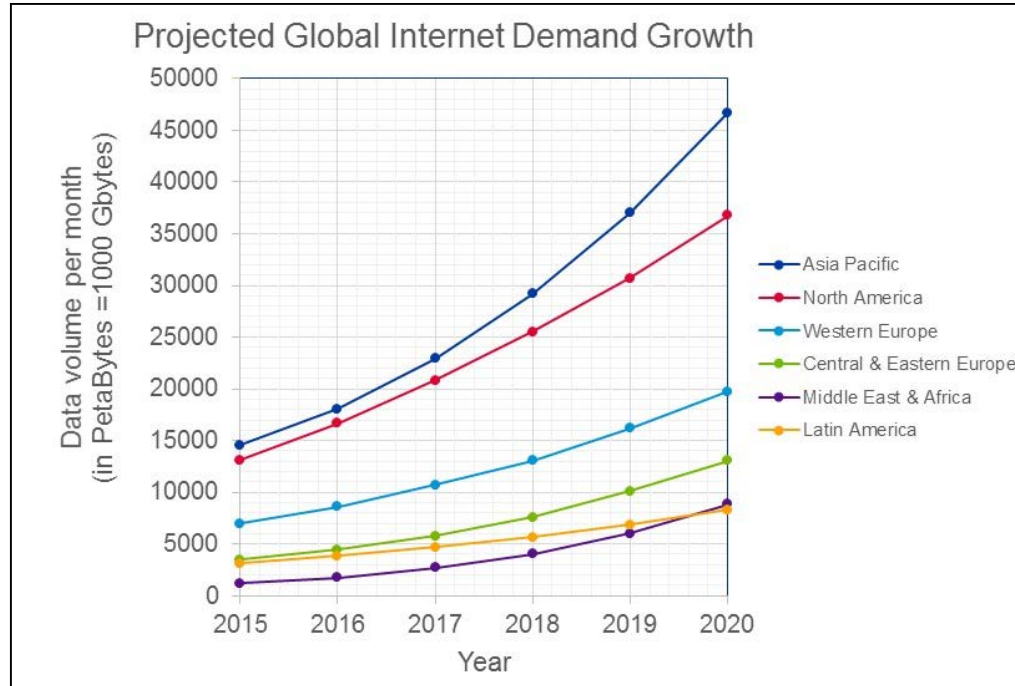
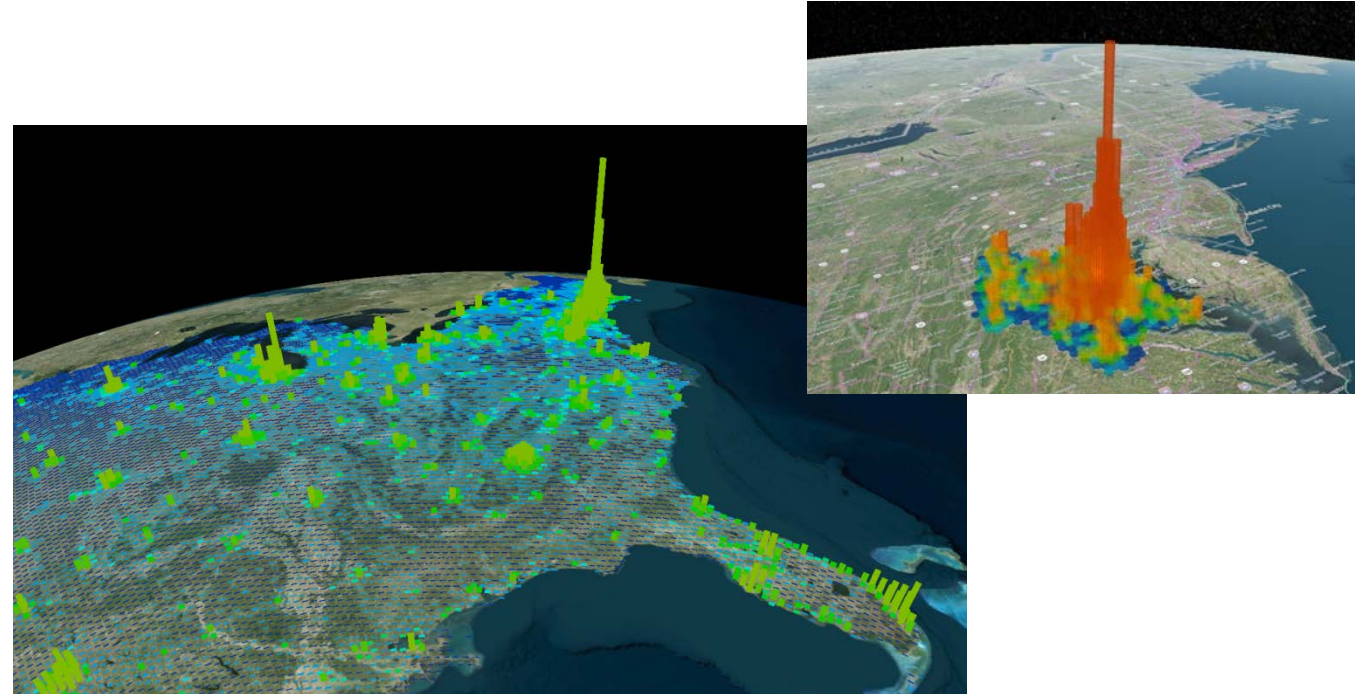


Figure II-2. Projected Global Internet Demand Growth (2017-2020)¹

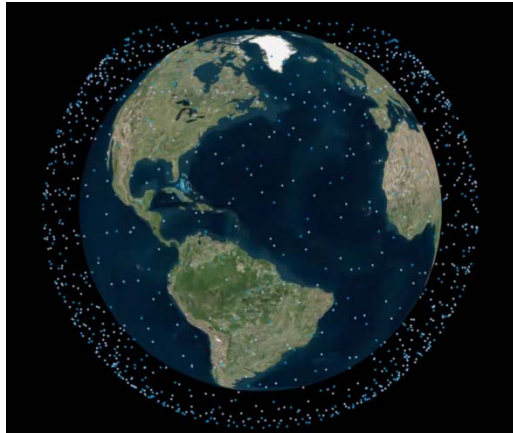
- **Broadband demand will continue to grow in all regions further aggravating urban/rural digital divide**

- **Satellite systems with sufficient spectrum can rapidly address the broad range of demand and permanently resolve urban/rural digital divide**



¹ Cisco Visual Networking Index Forecast and Methodology, 2015–2020, Table 8 (available at <http://www.cisco.com/c/dam/en/us/solutions/collateral/service-provider/visual-networking-index-vni/complete-white-paper-c11-481360.pdf>) (“Cisco Visual Networking Index Forecast”).

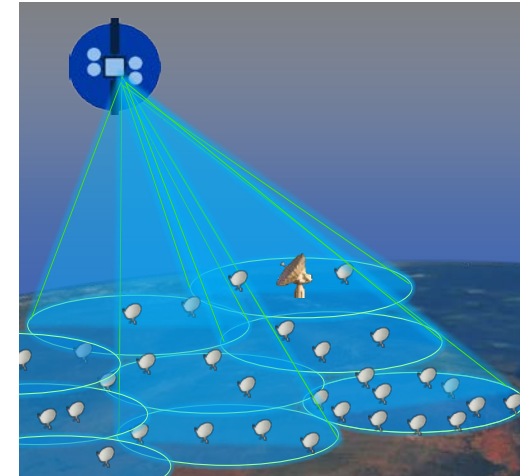
Boeing Global Broadband System Overview



Global Constellation

Spacecraft Qty: 1396/2956
Orbit Altitude: ~1200 km
Orbit Inclinations: 45°, 55° & 88°

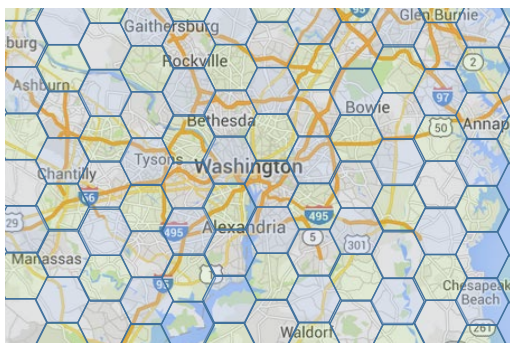
Provides Global Coverage



System Design

Broad Coverage LEO Satellites with Flexible Beam-forming Technology
Phased array antennas form robust links with high throughput and isolation and low side-lobe beams
Millimeter wave technology proven and deployed in government and commercial FSS and terrestrial systems

8 km cells over Washington DC



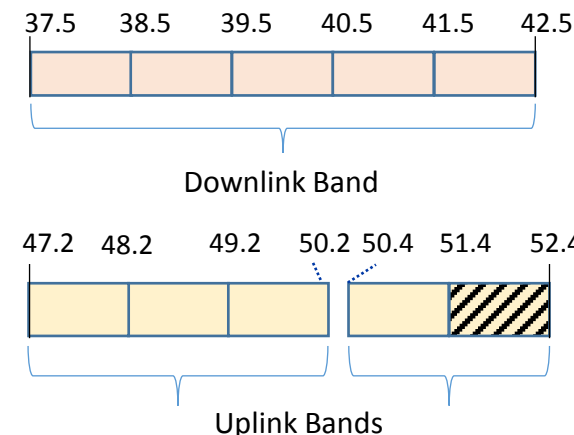
Service Density

3-Color (Time) reuse allows for very high throughput that is competitive to serve both urban and rural areas

Peak User Rates

Exceeds FCC's Broadband Goals
>25 Mbps Down / >3 Mbps Up

Broadband speeds are available to all global users

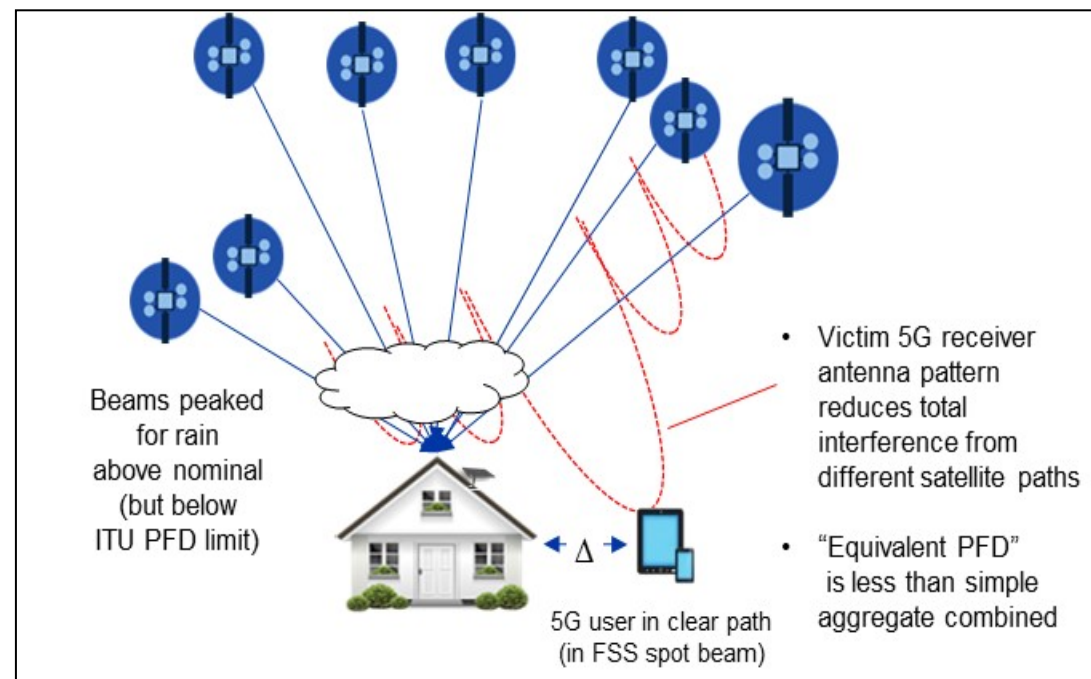


Frequency Plan

Each Beam uses all 5 GHz, dual polarization, up and down
Time domain division between adjacent cells
Gateways and user terminals share uplink and downlink bands

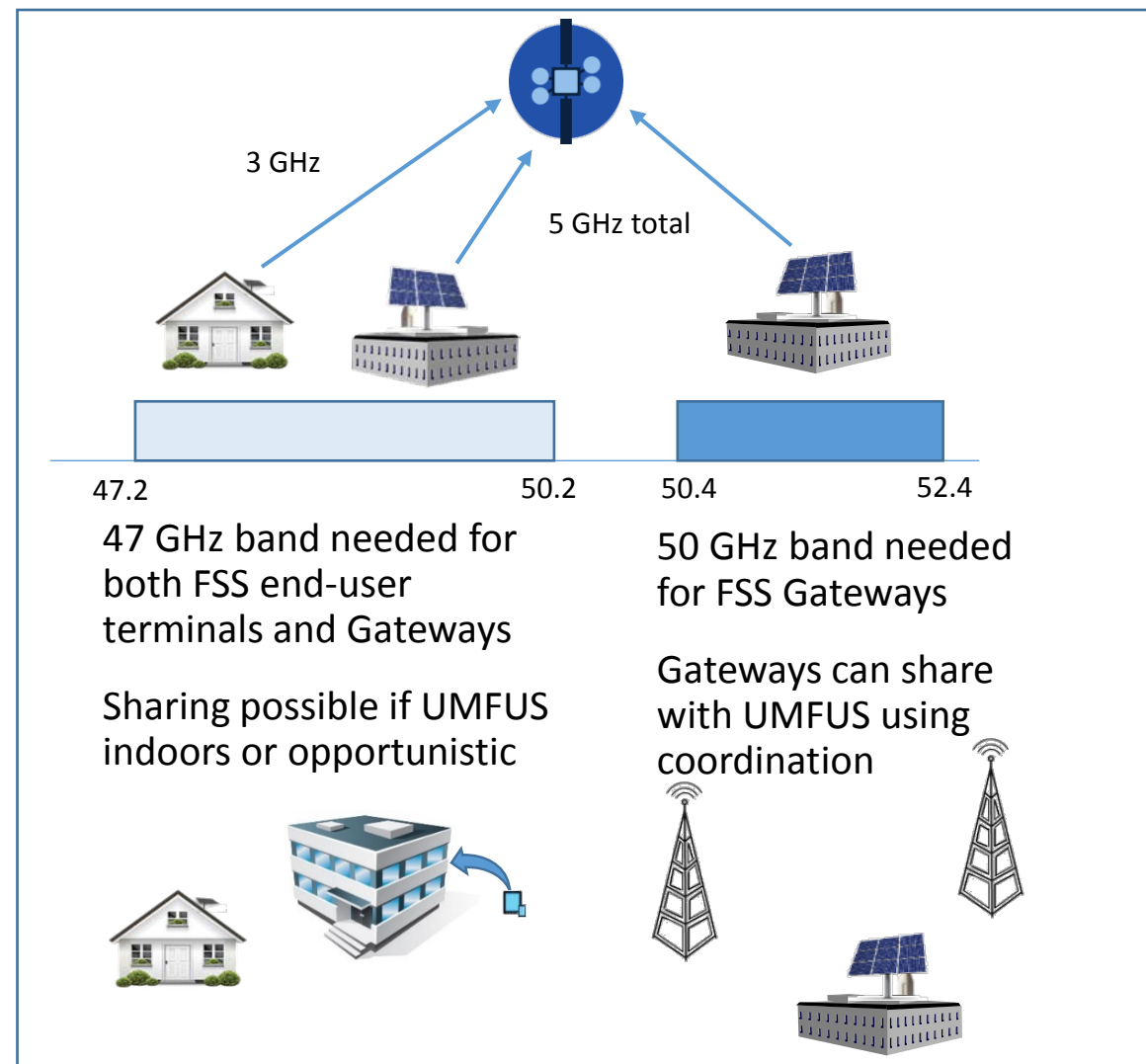
Broadband Satellite Downlink Requirements

- Satellite systems need access to an entire 5 GHz of paired V-band spectrum to provide broadband services with high efficiency and high re-use
- Boeing's sharing proposals provide UMFUS and FSS shared access to the majority of the 5 GHz of paired V-band spectrum
- Broadband forward links to end users require:
 - Full access to 40.0-42.0 GHz band
 - Opportunistic Access to 37.5-40.0 GHz band
 - Opportunistic Access to 42.0-42.5 GHz band
- Boeing's studies demonstrate aggregate satellite downlinks in the 37.5-40.0 GHz band at ITU PFD levels will not harm UMFUS systems



Broadband Satellite Uplink Requirements

- **Satellite systems require 5 GHz of matching Gateway uplink spectrum to service forward downlinks to satellite end user terminals**
 - Boeing's Gateways can be located in rural areas and will likely affect about 0.1% of U.S. population
 - Satellite Gateway locations should be coordinated with UMFUS systems on a first-in-time basis
 - Satellite Gateways cannot be restricted to 1 or 3 per PEA or to 0.1% of population in rural PEAs
- **Satellite end user terminals require 3 GHz of return uplink spectrum at 47.2-50.2 GHz**
 - Can share if UMFUS located indoors or allowed outdoors on an opportunistic secondary basis



Boeing's Spectrum Frontiers FNPRM Comments (1 of 2)

- **Broadband demand growth and persistent digital divide are compelling and requires very efficient terrestrial and satellite use of spectrum to resolve**
- **Satellite systems need access to an entire 5 GHz of paired V-band spectrum to provide broadband services with high efficiency and high re-use**
- **Boeing's sharing proposals provide UMFUS and FSS shared access to the majority of the 5 GHz of paired V-band spectrum**
 - **Individually-licensed satellite Gateways can share the entire 5 GHz of V-band uplink spectrum with UMFUS**
 - **Satellite end user terminals require unfettered access to 3 GHz of V-band uplink spectrum, but this spectrum can still be used by UMFUS services indoors or opportunistically**
 - **Satellite end user terminals can receive signals in the 37/39 GHz band with no interference to terrestrial services**
 - **Satellite downlink operations at the ITU PFD level cause negligible impact to UMFUS**
 - **The 42.0-42.5 GHz band can be authorized for both UMFUS and satellite downlink use**

Boeing's Spectrum Frontiers FNPRM Comments (2 of 2)

- **No action should be taken in 71-76 GHz, 81-86 GHz, and above 90 GHz bands**
 - Emerging technologies will enable use of these bands for satellites, HAPs, and terrestrial services
 - International rules currently in development by ITU and WRC are addressing uses of these bands
 - Additional development of sharing rules for the lower mmW bands will prepare the Commission to determine appropriate sharing rules for higher bands at a later time
- **Boeing participating in studies on unlicensed use of 57-71 GHz bands on aircraft**
- **Boeing concurs with Commission proposals regarding antenna height EIRP restrictions and EIRP scaling for all UMFUS devices**
 - EIRP scaling for mobiles and transportables is critical to UMFUS sharing with all other services (FSS, terrestrial FS, Federal FS, and Radio Astronomy)
 - UMFUS subnets operating indoors in restricted environments may consider other limitations
- **Boeing recommends appropriate use of statistical modeling to determine interference and spectrum sharing guidelines**